Multi-Scale Variability of Tropical Rainfall Systems in a Hierarchy of Aquaplanet Experiments

Tropical rainfall systems are important components of Earth’s climate system—from being key players in redistributing heat and moisture from the tropics to the high latitudes to manifesting into powerful high-impact phenomena (e.g., hurricanes) that can impact millions of lives around the world every year. Despite being so important, climate and weather prediction models struggle to accurately capture tropical weather systems and their multiscale variability. This is thought to be in part due to deficiencies in convection parameterizations or due to poor knowledge of how tropical systems of different scales interact with each other. This study tackles both issues by studying the multi-scale variability of tropical rainfall systems in a hierarchy of aquaplanet experiments with varying horizontal cell spacing—from 120 km to 3 km. In the first part of this talk, I will introduce the aquaplanet experiments and will demonstrate that storm-resolving resolution captures a broader range of tropical weather systems thanks in part to a better coupling between cold pools and rainfall. In the second part, I will present an example of multi-scale interactions between tropical weather systems through an analysis of equatorial Kelvin waves and their influence on tropical cyclogenesis frequency. I will conclude with a discussion of implications of this study to the future of climate and weather prediction of tropical rainfall.

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